^{106}In $\varepsilon+\beta^+$ decay (5.2 min)

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne and A. Negret	NDS 109,943 (2008)	1-May-2007

Parent: ^{106}In: E=28.6 *3*; $J^\pi=(2)^+$; $T_{1/2}$=5.2 min *1*; Q(ε)=6526 *11*; %ε+%β^+ decay=100

Experimental results are considered as tentative by the evaluators. A number of ε branches are inconsistent with the required ΔJ^π for $\varepsilon+\beta^+$ decay. This points to a very incomplete or wrong decay scheme See also decay of other ^{106}In isomer.

1978Hu06: source: ^{106}Cd(p,n) E=11,15 MeV. Measured: γ singles, $\gamma\gamma$ and $\beta\gamma$, β singles. Deduced: ^{106}Cd levels, J, π, log *ft*.

1984Ro10: source ^{106}In from Sn(p,2pxn), on-line mass separation. Measured Eγ, Iγ, Ice, $\gamma\gamma$ and γ(ce). Deduced: log *ft*, ^{106}Cd levels, J, π, α, mult.

1992Ku01: source: ^{106}Cd(p,n) E not given. Measured: Eγ, Iγ, ce(K), deduced: ^{106}Cd levels, J^π, α(K)exp, mult.

2007Li07: ^{106}In formed with ^{106}Cd(p,n) reaction using an 11 MeV proton beam. Measured Eγ, $\gamma\gamma$, Iγ, $\gamma\gamma(\theta)$ using the Horus Cube spectrometer comprised of four BGO-shielded HPGe detectors, five HPGe detectors, and the Cologne Euroball Cluster detector. Angular correlation defined by angles 55°, 70°, 90°, and 180° between the occupied detector positions. A possible candidate for quadrupole-octupole coupled 1^- state proposed at 2825 keV.

Others: 1969St18, 1972Me02, 1976Fl14.

^{106}Cd Levels

E(level)	J^π[‡]	$T_{1/2}$[†]	Comments
0.0	0^+	stable	
632.51 *9*	2^+	7.27 ps *9*	
1493.59 *13*	4^+	0.87 ps *11*	
1716.52 *9*	2^+	0.31 ps *5*	Iγ(1083.8γ)/Iγ(1716.4γ)=0.94 *17* (2007Li07).
1795.12 *14*	0^+		
2034.8?[#]			
2104.40 *12*	4^+		
2143.86 *18*	0^+		
2252.3 *3*	(4^+)		
2253.2 *3*	$(2^+,3^+)$		
2347.43 *22*	$(2)^+$		
2370.4 *3*	$(2)^+$		
2378.2 *4*	3^-		
2561.33 *6*	0^+		E(level): Observed only by 2007Li07.
2566.13 *14*	2^+		
2600.5?			
2629.20? *18*	5^-		
2630.0? *4*	2^+		
2719.83? *22*			
2824.5 *2*	$1^{(-)}$		E(level): In ε decay. Observed only by (2007Li07). Also observed in (γ,γ). No ε information given by these authors. J^π: possible quadrupole-octupole coupled state with $J^\pi=1^-$.
2889.44? *22*	$2,1^+$		
2917.6 *2*	$1^{(+)}$		
2920.10?[#] *24*	5		
2937.2?	$2^+,3^+$		
3118.9 *2*	1^+		
3222.3 *3*			E(level): From 2007Li07. Observed only by 2007Li07. No information on ε branchings.
3328.1? *5*	$1,2^+$		
3427.3?	$2,3^+,4^+$		
3494.6 *4*	$1,2^+$		

[†] Taken from Adopted Levels.

[‡] From Adopted Levels.

[#] Observed only by 1984Ro10. Not clear whether level belongs to ε decay of ^{106}In(6.2 min) or to the ε decay of ^{106}In(5.2 min).

^{106}In $\varepsilon+\beta^+$ decay (5.2 min) (continued)

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ †	Iε†	Log *ft*	I($\varepsilon+\beta^+$)†	Comments
(3060 *11*)	3494.6	2.23 *9*	1.35 *6*	5.707 *21*	3.58 *14*	av Eβ= 910 *5*; εK= 0.326 *4*; εL= 0.0414 *5*; εM+= 0.01031 *11*
(3227 *11*)	3328.1?	0.31 *7*	0.15 *4*	6.71 *10*	0.46 *10*	av Eβ= 987 *5*; εK= 0.278 *3*; εL= 0.0353 *4*; εM+= 0.00880 *10*
(3436 *11*)	3118.9	1.21 *10*	0.44 *4*	6.30 *4*	1.65 *13*	av Eβ= 1083 *5*; εK= 0.2286 *24*; εL= 0.0290 *3*; εM+= 0.00722 *8*
(3637 *11*)	2917.6	3.65 *17*	1.03 *5*	5.977 *23*	4.68 *21*	av Eβ= 1176 *6*; εK= 0.1897 *20*; εL= 0.02402 *25*; εM+= 0.00599 *6*
(3665 *11*)	2889.44?	3.93 *24*	1.07 *7*	5.97 *3*	5.0 *3*	av Eβ= 1190 *6*; εK= 0.1848 *19*; εL= 0.02340 *24*; εM+= 0.00583 *6*
(3835 *11*)	2719.83?	1.80 *9*	0.405 *20*	6.428 *23*	2.20 *10*	av Eβ= 1269 *6*; εK= 0.1589 *16*; εL= 0.02010 *20*; εM+= 0.00501 *5*
(3925 *11*)	2630.0?	1.75 *9*	0.359 *18*	6.500 *24*	2.11 *10*	av Eβ= 1310 *6*; εK= 0.1469 *14*; εL= 0.01859 *18*; εM+= 0.00463 *5* log *ft* inconsistent with ΔJ^π requirements. Direct ε feeding almost excluded. Probably an important fraction of γ's deexciting higher lying levels has been missed.
(3989 *11*)	2566.13	5.9 *13*	1.13 *25*	6.02 *10*	7.0 *15*	av Eβ= 1340 *6*; εK= 0.1391 *14*; εL= 0.01759 *17*; εM+= 0.00439 *5*
(4176 *11*)	2378.2	1.19 *9*	0.190 *14*	6.83 *4*	1.38 *10*	av Eβ= 1428 *6*; εK= 0.1189 *11*; εL= 0.01502 *14*; εM+= 0.00375 *4*
(4184 *11*)	2370.4	1.59 *12*	0.252 *18*	6.71 *4*	1.84 *13*	av Eβ= 1432 *6*; εK= 0.1181 *11*; εL= 0.01493 *14*; εM+= 0.00372 *4*
(4207 *11*)	2347.43	12.4 *10*	1.92 *15*	5.83 *4*	14.3 *11*	av Eβ= 1443 *6*; εK= 0.1159 *11*; εL= 0.01465 *14*; εM+= 0.00365 *4*
(4411 *11*)	2143.86	0.39 *5*	0.050 *6*	7.46 *5*	0.44 *5*	av Eβ= 1539 *6*; εK= 0.0985 *9*; εL= 0.01244 *11*; εM+= 0.00310 *3*
(4450 *11*)	2104.40	2.5 *7*	0.31 *8*	6.67 *11*	2.8 *7*	av Eβ= 1557 *6*; εK= 0.0955 *9*; εL= 0.01206 *11*; εM+= 0.00301 *3* log *ft* inconsistent with ΔJ^π requirements. Direct ε feeding almost excluded. Probably an important fraction of γ's deexciting higher lying levels has been missed.
(4760 *11*)	1795.12	1.09 *12*	0.104 *12*	7.21 *5*	1.19 *13*	av Eβ= 1704 *6*; εK= 0.0757 *6*; εL= 0.00956 *8*; εM+=0.002382 *20* log *ft* inconsistent with ΔJ^π requirements. Direct ε feeding almost excluded. Probably an important fraction of γ's deexciting higher lying levels has been missed.
(4838 *11*)	1716.52	6.2 *5*	0.56 *5*	6.49 *4*	6.8 *5*	av Eβ= 1741 *6*; εK= 0.0715 *6*; εL= 0.00903 *8*; εM+=0.002251 *18*
(5061 *11*)	1493.59	7.2 *15*	0.55 *12*	6.54 *9*	7.8 *16*	av Eβ= 1847 *6*; εK= 0.0612 *5*; εL= 0.00773 *6*; εM+=0.001925 *15* log *ft* inconsistent with ΔJ^π requirements. Direct ε feeding almost excluded. Probably an important fraction of γ's deexciting higher lying levels has been missed.
(5922 *11*)	632.51	37.7 *23*	1.62 *10*	6.20 *3*	39.3 *24*	av Eβ= 2258 *6*; εK= 0.03570 *23*; εL= 0.00450 *3*; εM+= 0.001121 *8* E(β^+)=4.82 MeV *15* (1978Hu06) β singles, $\beta(633\gamma)$. Other: 4.89 MeV *3* (1966Ca09) $\beta(633\gamma)$, β singles.

† Absolute intensity per 100 decays.

^{106}In $\varepsilon+\beta^+$ decay (5.2 min) (continued)

$\gamma(^{106}Cd)$

Iγ normalization: for I(γ+ce)=100 to g.s.; negligible IT decay is assumed. ΔIγ(1716γ)=50% assumed by the evaluators.
α(K)exp: from 1992Ku01. Normalized to α(K)exp(633γ)=0.0035 *1* [E2 theory from Bricc].

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	α[‡]	Comments
[x]308.9 *2*									
[x]314.6 *2*									
387.7 *2*		2104.40	4^+	1716.52	2^+	E2		0.0143	
[x]390.7 *2*									
[x]395.5 *2*									
427.2 *3*	0.14 *2*	2143.86	0^+	1716.52	2^+	E2			E_γ,I_γ: from 1992Ku01.
[x]438.6 *2*									
495.6[&] *2*		2600.5?		2104.40	4^+				
524.6 *2*		2629.20?	5^-	2104.40	4^+	E1		0.0019	
536.2 *3*		2253.2	$(2^+,3^+)$	1716.52	2^+				
553.0 *2*		3118.9	1^+	2566.13	2^+				Iγ(553)/Iγ(557)/Iγ(748)/Iγ(1324)/ Iγ(1402)/Iγ(2486)/ Iγ(\3118)= 12/4/15/3/7/100/96 (2007Li07). E_γ: From 2007Li07.
557.8 *2*		3118.9	1^+	2561.33	0^+	M1			E_γ,Mult.: From 2007Li07.
575.2 *5*	0.4 *1*	2370.4	$(2)^+$	1795.12	0^+	E2			α(K)exp=0.0036 *5* Mult.: from α(K)exp.
610.7 *2*	1.5 *7*	2104.40	4^+	1493.59	4^+	E2		0.0035	α(K)exp=0.0037 *4* I_γ: unweighted average of 2.2 *8* (1978Hu06) and 0.8 *2* (1976Fl14).
632.66 *4*	100	632.51	2^+	0.0	0^+	E2		0.0035	α(K)exp=0.0030 *10* E_γ: From 2007Li07.
[x]636.2 *2*									
[x]690.9 *2*									
748.5 *1*		3118.9	1^+	2370.4	$(2)^+$				E_γ: From 2007Li07.
758.8 *3*		2252.3	(4^+)	1493.59	4^+				E_γ: from 1992Ku01.
[x]802.1 *2*									
[x]808.3 *2*									
861.1 *1*	10.0 *16*	1493.59	4^+	632.51	2^+	E2		0.0016	α(K)exp=0.0014 *1* I_γ: unweighted average of 11.6 *18* (1978Hu06) E(n) 8.5 *11* (1976Fl14).
980.7 *4*	0.5 *1*	3328.1?	$1,2^+$	2347.43	$(2)^+$				E_γ: different placement given by 1984Ro10.
[x]1063.7 *2*									
[x]1076.9 *2*									
1083.8 *1*	3.4 *2*	1716.52	2^+	632.51	2^+	E2+M1	−1.53 *14*	0.0010	α(K)exp=0.00084 *10* E_γ,Mult.,δ: From 2007Li07. I_γ: From 1978Hu06. Other: 3.0 *8* (1976Fl14).
1122.4 *2*		2917.6	$1^{(+)}$	1795.12	0^+	(M1)			Iγ(1122γ)/Iγ(1201γ)/Iγ(2285γ)/ Iγ(2918γ)=4/2/22/100 (2007Li07). E_γ,Mult.: from 2007Li07.
1135.8 *2*		2629.20?	5^-	1493.59	4^+				I_γ: from 1980Wi20.
1162.6 *1*	1.7 *1*	1795.12	0^+	632.51	2^+	E2			α(K)exp=0.00068 *9* I_γ: other: 1.0 *6* (1976Fl14).
[x]1173.7 *2*									

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^{106}In $\varepsilon+\beta^+$ decay (5.2 min) (continued)

$\gamma(^{106}Cd)$ (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	α[‡]	Comments
1201.0 *1*		2917.6	$1^{(+)}$	1716.52	2^+	M1+E2	+0.17 *11*		E_γ,Mult.,δ: from 2007Li07.
[x]1243.3 *2*									
[x]1298.8 *2*									
1324.0 *2*		3118.9	1^+	1795.12	0^+	M1			E_γ,M1: From 2007Li07.
[x]1373.6 *2*									
1402.1[&] *2*		2034.8?		632.51	2^+				E_γ: Observed only by 1984Ro10, not confirmed by coincidences.
1402.6 *2*		3118.9	1^+	1716.52	2^+				E_γ: From 2007Li07.
1426.5 *2*		2920.10?	5	1493.59	4^+				E_γ: Observed only by 1984Ro10.
1427.2 *2*		3222.3		1795.12	0^+				E_γ: From 2007Li07.
1471.9 *1*	1.5 *3*	2104.40	4^+	632.51	2^+	E2		0.00057	α(K)exp=0.00037 *5* I_γ: other: 1.4 *5* (1978Hu06).
[x]1505.9 *2*									
1511.4 *3*	0.34 *5*	2143.86	0^+	632.51	2^+	E2			E_γ,I_γ: from 1992Ku01.
[x]1518.6 *2*									
[x]1524.9 *2*									
[x]1550.5 *2*									
1619.6 *6*		2252.3	(4^+)	632.51	2^+				E_γ: from 1992Ku01. α(K)exp: α(K)exp=0.00034 *5* for doublet of 1619.6γ + 1621.4γ. I_γ: a value of 5.4 *3* for the doublet of 1619.6γ + 1621.4γ is given for the decay of the two isomers together by (1992Ku01).
1621.4 *4*		2253.2	$(2^+,3^+)$	632.51	2^+				α(K)exp: α(K)exp=0.00034 *5* for doublet of 1619.6γ + 1621.4γ. I_γ: a value of 5.4 *3* for the doublet of 1619.6γ + 1621.4γ is given for the decay of the two isomers together by (1992Ku01).
[x]1622.1 *2*									
[x]1633.2 *2*									
1714.9 *2*	16.1 *11*	2347.43	$(2)^+$	632.51	2^+				E_γ: from 1984Ro10. Others: 1714.7 *3* (1992Ku01), 1716.4 (1978Hu06). I_γ: obtained from Iγ(doublet 1715γ)=20.3 − Iγ(1716γ from 1716 level)=4.2 *5* (1978Hu06).
1716.47 *8*	4.2 *5*	1716.52	2^+	0.0	0^+	E2			E_γ: Weighted average of 1716.4 *1* (1978Hu06),1716.7 *2* (1984Ro10) and 1716.5 *2* (2007Li07). I_γ: calculated based on the weighted average of the ratio Iγ(1084γ)/Iγ(1716γ)=0.81 *8* obtained from 0.70 *9* (Coul. Ex); 1.02 *19* (n,n′γ); 1.17 *25* (p,p′γ) and 0.91 *20* (p,2nγ). Mult.: From 2007Li07.
1737.9 *3*	1.6 *1*	2370.4	$(2)^+$	632.51	2^+				I_γ: other: <1.2 (1976Fl14).
1745.7 *3*	1.5 *1*	2378.2	3^-	632.51	2^+	E1			α(K)exp<0.00015 I_γ: other: 1.1 *7* (1976Fl14).
[x]1757.1 *2*									
[x]1853.3 *2*									
[x]1896.4 *2*									
1928.69 *5*		2561.33	0^+	632.51	2^+				

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^{106}In $\varepsilon+\beta^+$ decay (5.2 min) (continued)

$\gamma(^{106}Cd)$ (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	Comments
1933.6 *1*	7.6 *16*	2566.13	2^+	632.51	2^+			I_γ: unweighted average of 9.1 *5* (1976Hu06) and 6.0 *7* (1976Fl14).
1997.5 *3*	2.3 *1*	2630.0?	2^+	632.51	2^+			E_γ: not observed by 1984Ro10. $I\gamma$ other: 4.2 *10* (1976Fl14).
[x]2005.3 *2*								
[x]2046.2 *2*								
2087.3 *2*	2.4 *1*	2719.83?		632.51	2^+			E_γ: other placement suggested by 1984Ro10. I_γ: other: 2.6 *7* (1976Fl14).
2143.9 *3*		2143.86	0^+	0.0	0^+	E0		α(K)exp>0.042 α(K)exp: α(K)exp>35(α(K)exp (M4)). E_γ,I_γ: from 1992Ku01.
[x]2225.7 *2*								
2256.87 *17*	5.4 *3*	2889.44?	2,1^+	632.51	2^+			E_γ: Weighted average of 2256.9 *3* (1978Hu06 and 2256.8 *3* (2007Li07). I_γ: other: 4.9 *9* (1976Fl14).
2284.8 *2*	0.9 *1*	2917.6	$1^{(+)}$	632.51	2^+	M1+E2	+0.045 *46*	E_γ,Mult.,δ: From 2007Li07. I_γ: other: 1.6 *4* (1976Fl14).
2304.6[&] *6*	0.5 *1*	2937.2?	2^+,3^+	632.51	2^+			E_γ: not observed by 1984Ro10. I_γ: other: 1.4 *6* (1976Fl14).
[x]2390.3 *2*								
[x]2414.1 *2*								
[x]2449.0 *2*								
2486.6 *6*	1.1 *1*	3118.9	1^+	632.51	2^+	M1+E2	−0.87 *7*	E_γ,Mult.,δ: From 2007Li07. I_γ: other: 2.4 *8* (1976Fl14).
[x]2494.3 *2*								
[x]2551.4 *2*								
[x]2586.2 *2*								
2590.5 *3*		3222.3		632.51	2^+			E_γ: From 2007Li07.
2600.7[&] *2*		2600.5?		0.0	0^+			
2696.8[&] *5*	1.0 *11*	3328.1?	1,2^+	632.51	2^+			E_γ: not observed by 1984Ro10. I_γ: From (1978Hu06). Other: 0.8 *5* (1976Fl14).
2794.7[&] *5*	0.9 *1*	3427.3?	2,3^+,4^+	632.51	2^+			E_γ: not observed by 1984Ro10. I_γ: other: 0.7 *5* (1976Fl14).
2824.5 *2*		2824.5	$1^{(-)}$	0.0	0^+			
2862.1 *5*	1.6 *1*	3494.6	1,2^+	632.51	2^+			I_γ: other: 0.9 *5* (1976Fl14).
2889.5 *3*		2889.44?	2,1^+	0.0	0^+			E_γ: Observed only by 2007Li07; $I\gamma(2256\gamma)/I\gamma(2889\gamma)$=100/31 (2007Li07).
2918.2 *3*	4.2 *2*	2917.6	$1^{(+)}$	0.0	0^+			I_γ: other: 3.8 *7* (1976Fl14).
3118.8 *1*	0.7 *1*	3118.9	1^+	0.0	0^+	M1		E_γ,Mult.: From 2007Li07.
3222 *3*		3222.3		0.0	0^+			E_γ: From 2007Li07.
[x]3223.0 *5*	0.8 *1*							
[x]3394.5 *4*	1.1 *1*							
3494.5 *5*	2.3 *1*	3494.6	1,2^+	0.0	0^+			
[x]3889.2 *5*	0.9 *1*							
[x]3912.0 *8*	0.5 *2*							

[†] $E\gamma$ with $I\gamma$ values are from 1978Hu06, unless otherwise noted. $E\gamma$ values for transitions with no $I\gamma$ are from 1984Ro10. For $I\gamma$ see 1984Ro10, not given for ^{106}In(5.2 min) and ^{106}In(6.2 min) ε decay separately. Unassigned γ's of 1984Ro10 given in both decays.

[‡] From 1984Ro10.

[#] Based on conversion electron data (1984Ro10) and α(K)exp and $\gamma(\theta)$ (1992Ku01) if available.

[@] For absolute intensity per 100 decays, multiply by 0.918 *8*.

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^{106}In $\varepsilon+\beta^+$ decay (5.2 min) (continued)

$\gamma(^{106}Cd)$ (continued)

[&] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

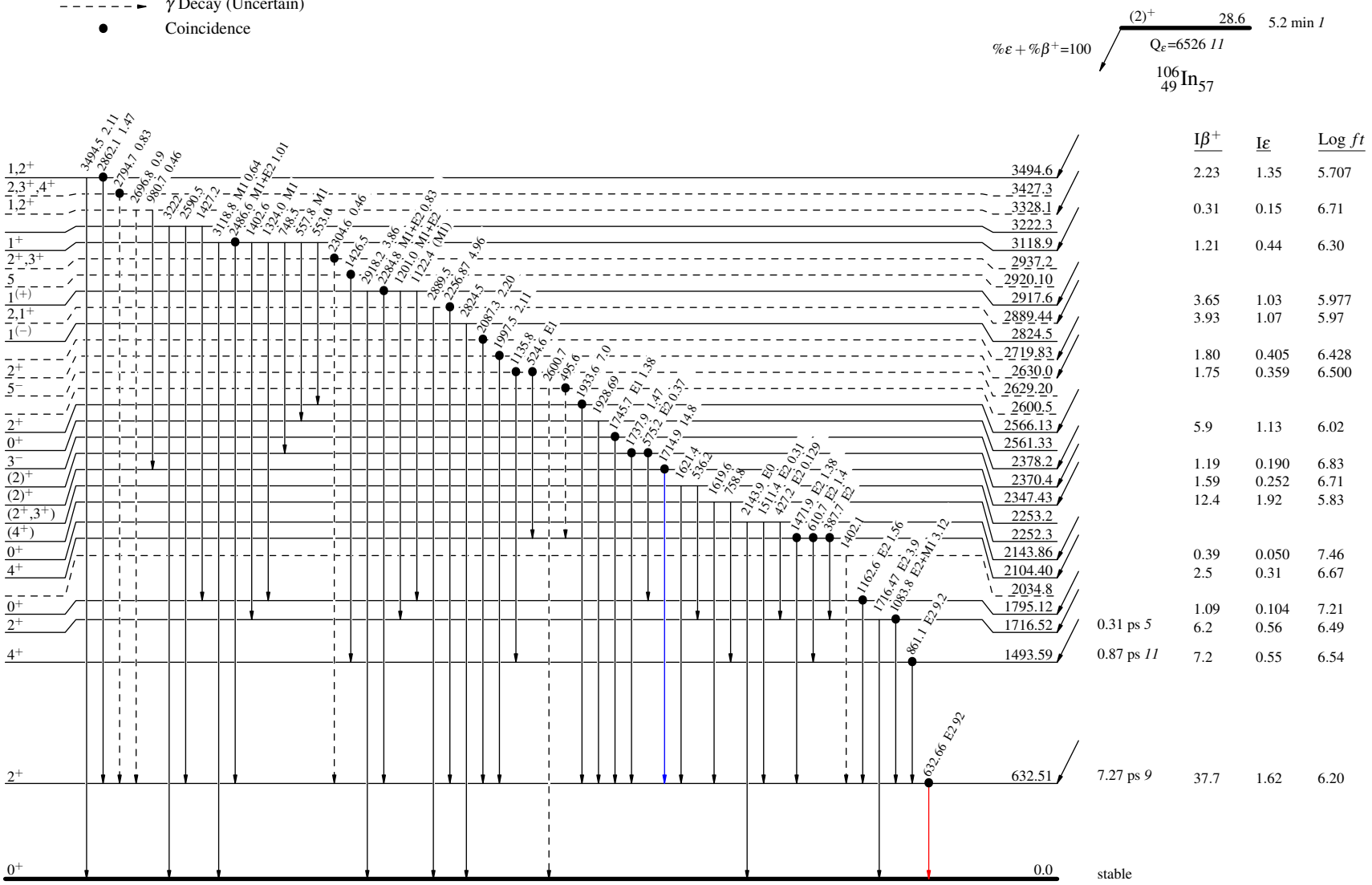
^{106}In ε decay (5.2 min)

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence



	Iβ+	Iε	Log *ft*
	2.23	1.35	5.707
	0.31	0.15	6.71
	1.21	0.44	6.30
	3.65	1.03	5.977
	3.93	1.07	5.97
	1.80	0.405	6.428
	1.75	0.359	6.500
	5.9	1.13	6.02
	1.19	0.190	6.83
	1.59	0.252	6.71
	12.4	1.92	5.83
	0.39	0.050	7.46
	2.5	0.31	6.67
	1.09	0.104	7.21
	6.2	0.56	6.49
	7.2	0.55	6.54
	37.7	1.62	6.20

$^{106}_{48}Cd_{58}$

$^{106}_{48}Cd_{58}$-7